Remarks/Arguments

Applicants respectfully requests further examination and reconsideration in view of the amendments above and arguments set forth fully below. Claims 1-123 were previously pending in the present application. Within the Office Action, Claims 1-9, 11-54, 57-94, and 97-123 stand rejected, and Claims 10, 55, 56, 95, and 96 are objected to. By way of the above amendments, Claims 1, 9, 12, 42, 49, and 84 are amended. Accordingly, Claims 1-123 are currently pending in this application.

Amendments to the Specification

By the above amendments to the specification, typographical errors are corrected. These amendments are made such that the reference numerals within the specification match those within the Figures. No new matter is added by way of these amendments.

Amendments to the Drawings

By the above amendments to the drawings, and included within the attached replacement drawings, Figures 4A, 5, 6, and 7A are amended to correct typographical errors. These amendments are made such that the reference numerals within the drawings match those within the specification. No new matter is added by way of these amendments.

Objections to the Claims

Within the Office Action, it is stated that Claims 9, 12, and 49 are objected to because each contains functional language "adapted" which does not have patentable weight. By the above amendments, Claims 9, 12, and 49 are amended to replace "adapted" with "configured".

Rejections under 35 U.S.C. §102

Within the Office Action, Claims 1-9, 11-54, 57-94, and 97-123 stand rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,388,635 to Gruber et al. (hereafter "Gruber"). The Applicants respectfully traverse this rejection for the following reasons.

Gruber discloses a cooling hat which includes a coldsheet and several manifold layers for removing heat from a plurality of integrated circuit chips (Gruber, col. 5, lines 19-23). Heat is removed from the integrated circuit chips through conduction and a coolant fluid. Heat generated by the integrated circuit chips is conducted away from the source, through a thermal

joint and to the coldsheet. Coolant fluid flows from above through a main supply port, into many supply ducts and through a capillary sheet. A reservoir for fluid is created at the coldsheet. The fluid carries heat from the coldsheet out through return ducts and a return port.

Additionally, Gruber teaches that the coldsheet and manifold layers each are "global", namely, each coldsheet and manifold layer is for cooling all chips on the substrates (Gruber, col. 6, lines 40-43). Gruber also teaches that the patterns of conduits, or grooves, in the finest tier of the manifold can be locally modified in order to "personalize" the cooling (Gruber, col. 15, lines 31-37). However, Gruber defines "personalize" as providing a tape layer 110 with perforations 112 between the coldsheet 14 and the finest manifold layer 16, such that the area of each perforation 112 matches a power generated by an associated individual chip 116 or 118 (Gruber, Figures 16A and 16B; col. 15, lines 19-26). As such, Gruber teaches modifying a configuration of the finest manifold layer to correspond to varying power generated, and thereby heat generated, on a per chip basis. Any heat removed by the Gruber device is removed uniformly across the entire chip. As such, any existing temperature gradient that exists across the chip's surface will substantially remain after the uniform heat removal across the entire surface.

Gruber teaches a uniform fluid distribution across the entire interface surface of the chip, which leads to a substantially uniform temperature drop across the entire chip. Therefore, where a temperature gradient exists across the interface surface prior to cooling by the fluid, the overall temperature drops after the cooling, but a temperature gradient still exists. A temperature gradient still exists across the interface surface after the cooling process is performed. Gruber teaches a process that delivers a substantially similar temperature drop across the entire interface surface of the chip. There is no consideration for applying select amounts of cooling fluid to predetermined locations on a given chip in order to selectively cooling hot spot regions on the chip. In summary, Gruber does not teach controllably channeling select amounts of a cooling fluid to specific hot spot regions on the chip.

The present invention is also directed to a heat exchanger including a manifold layer that directs cooling fluid directly to specific hot spot regions within a given integrated chip. The present invention teaches that fluid enters the manifold layer via an inlet port and flows along an inlet channel to several fingers which branch out from the channel in several directions to apply fluid to selected regions in the interface layer. Further, the locations of the hot spots as well as the amount of heat produced near or at each hot spot are used to configure the manifold layer such that the fingers are placed above or proximal to the interface hot spot regions in the

interface layer. Thus, the present invention tailors the geometries of the fingers of the manifold layer and the channels to aid in optimizing hot spot cooling within a given heat source. Such a configuration enables a reduction in temperature differences across the heat source while maintaining an optimal pressure drop within the heat exchanger. Gruber does not teach modifying a configuration of the manifold layer to correspond to specific hot spots within a given heat source. Therefore, Gruber does not teach a method of minimizing temperature differences across the given heat source.

The amended independent Claim 1 is directed to method of controlling temperature of a heat source in contact with a heat exchanging surface of a heat exchanger, wherein the heat exchanging surface is substantially aligned along a plane. The method comprises controllably channeling a selectable amount of a first temperature fluid to one or more predetermined locations on the heat exchanging surface, wherein the first temperature fluid undergoes thermal exchange with the heat source along the heat exchanging surface, and channeling a second temperature fluid from the heat exchange surface, wherein fluid is channeled to minimize temperature differences along the heat source. As discussed above, Gruber does not teach channeling fluid to minimize temperature differences along a heat source. Further, Gruber does not teach controllably channeling select amounts of a cooling fluid to one or more specific regions on the heat source. For at least these reasons the independent Claim 1 is allowable over the teachings of Gruber.

Because Claims 2-9 and 11-41 depend from allowable Claim 1, they are each also in a condition for allowance.

The amended independent Claim 42 of the present invention is directed toward a heat exchanger for controlling a heat source temperature. The heat exchanger comprises a first layer in substantial contact with the heat source and configured to perform thermal exchange with fluid flowing in the first layer, the first layer aligned along a first plane, and a second layer coupled to the first layer for controllably channeling selectable amounts of fluid to one or more predetermined locations within the first layer and for channeling fluid from the first layer, wherein the one or more predetermined locations within the first layer correspond to one or more predetermined locations on the heat source, further wherein the heat exchanger is configured to minimize temperature differences along the heat source.. As discussed above, Gruber does not teach configuring a heat exchanger to minimize temperature differences along a heat source. Further, Gruber does not teach controllably channeling select amounts of a cooling fluid to one

or more specific regions on the heat source. For at least these reasons the independent Claim 42 is allowable over the teachings of Gruber.

Because Claims 43-54 and 57-83 depend from allowable Claim 42, they are each also in a condition for allowance.

The amended independent Claim 84 is directed to a hermetic closed loop system for controlling a temperature of a heat source. The system comprises at least one heat exchanger for controlling the temperature of the heat source by controllably channeling selectable amounts of a fluid to one or more predetermined locations on the heat source, wherein the heat exchanger is configured to minimize temperature differences in the heat source, at least one pump for circulating fluid throughout the loop, the at least one pump coupled to the at least one heat exchanger, and at least one heat rejector coupled to the at least one pump and the at least one heat exchanger. As discussed above, Gruber does not teach configuring a heat exchanger to minimize temperature differences along a heat source. Further, Gruber does not teach controllably channeling select amounts of a cooling fluid to one or more specific regions on the heat source. For at least these reasons the independent Claim 84 is allowable over the teachings of Gruber.

Because Claims 85-94 and 97-123 depend from allowable Claim 84, they are each also in a condition for allowance.

For the reasons given above, the Applicants respectfully submit that the claims are in a condition for allowance, and allowance at an early date would be appreciated. If the Examiner has any questions or comments, he is encouraged to call the undersigned at (408) 530-9700 so that any outstanding issues can be expeditiously resolved.

Respectfully submitted,
HAVERSTOCK & OWENS LLP

Dated: 10-13-04 By: Thomas B. Haverstock

Thomas B. Haverstock
Reg. No.: 32,571
Attorneys for Applicants